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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

No. 2] [1924

IV.—CONTRIBUTIONS TOWARDS A PHYLOGENETIC CLASSIFICATION OF FLOWERING PLANTS: III.*

J. Hutchinson.

The Genera of Gymnosperms.

The following families of Gymnosperms are now generally recognised: 1. **Cycadaceae,** 2. **Ginkgoaceae,** 3. **Taxaceae,** 4. **Pinaceae,** 5. **Gnetaceae.** This contribution provides keys to the genera of *Cycadaceae* (below), *Taxaceae* (p. 53) and *Pinaceae* (p. 57), and a map showing the distribution of the three genera of *Gnetaceae* (p. 66), i.e. *Ephedra*, *Gnetum* and *Welwitschia*. The family *Ginkgoaceae*, formerly included in the *Taxaceae*, is represented by the single genus and species *Ginkgo biloba*. From a purely morphological point of view *Ginkgo* finds its true affinities in the *Taxaceae*, but chiefly on account of its ancient fern-like character, the motile antherozoids, it is separated as a family. Extensive bibliographies on *Ginkgo* will be found in the following: Seward, "The Maidenhair Tree (*Ginkgo biloba*)" in Annals of Botany 14: 109–154 (1900); Seward, Fossil Plants 4: 1–105 (1919).

CYCADACEAE.

Key to the Tribes and Genera.

Tribe I. Cycadeae. Leaf-segments circinately involute in bud; pinnae with a central midrib but no lateral nerves. Female sporophylls borne separately like foliage-leaves and not in cones (the central axis continuing to grow after flowering), pectinate in the upper part, bearing on their lower margins 2 or more ovules; ovules ascending - - - - - **1. Cycas.**

* Continued from *K.B.*, 1923, p. 261.

(17982.) Wt. 396. P. 32. 1000. 3/24. Wy. & S., Ltd. Gp. 50. (4.)

Tribe II. ENCEPHALARTEAE. Leaf-segments straight in bud, imbricate. Female sporophylls scale-like and forming cones which fall off after flowering; scales peltate, bearing one inverted ovule on each side.

Subtribe 1. *Encephalartineae.* Cone-scales imbricate in an alternating series. Trunk cylindric or ovoid, covered with the persistent bases of the leaves and prophylls. Leaf-segments with longitudinally parallel nerves.

Leaves deeply pinnatisect, with pungent segments; cone-scales lax, shortly stipitate, flat, erect, ovate, cordate; ovules inserted on a hook-like process on each side of the stalk; Mexico - - - - - - 2. **Dioon.**

Leaves pinnate; Africa and Australia:

Female cone-scales with a thickened and ascending peltate limb, often produced into an acuminate spine-like blade; Australia - - - - - 3. **Macrozamia.**

Female cone-scales with a peltate, thickened, more or less truncate, decurved limb; Africa 4. **Encephalartos.**

Subtribe 2. *Stangerineae.* Cone-scales as in previous subtribe. Trunk rhizomatous or turnip-like, nude. Leaf-segments with a midrib and numerous lateral nerves at right angles 5. **Stangeria.**

Subtribe 3. *Zamineae.* Cone-scales superposed in vertical series. Scales hexagonous and valvate. Leaf-segments as in subtribe *Encephalartineae.*

Leaves bipinnate; stem nude, underground; N. Australia - - 6. **Bowenia.**

Leaves pinnate; America:

Male and female cone-scales 2-horned - - - - - - 7. **Ceratozamia.**

Male and female cone-scales not horned:

Trunk cylindric, covered with persistent leaf-bases and prophylls; cone-scales woolly-tomentose - - - - - 8. **Microcycas.**

Trunk sometimes partly below the soil, nude; cone-scales not hairy - - - 9. **Zamia.**

Tribe I.—Cycadeae.

1. **Cycas** *Linn.*—30 spp., Tropics and Subtropics of Old World ; type sp.* *C. circinalis*, Ceylon and S. India.

Tribe II.—Encephalarteae.

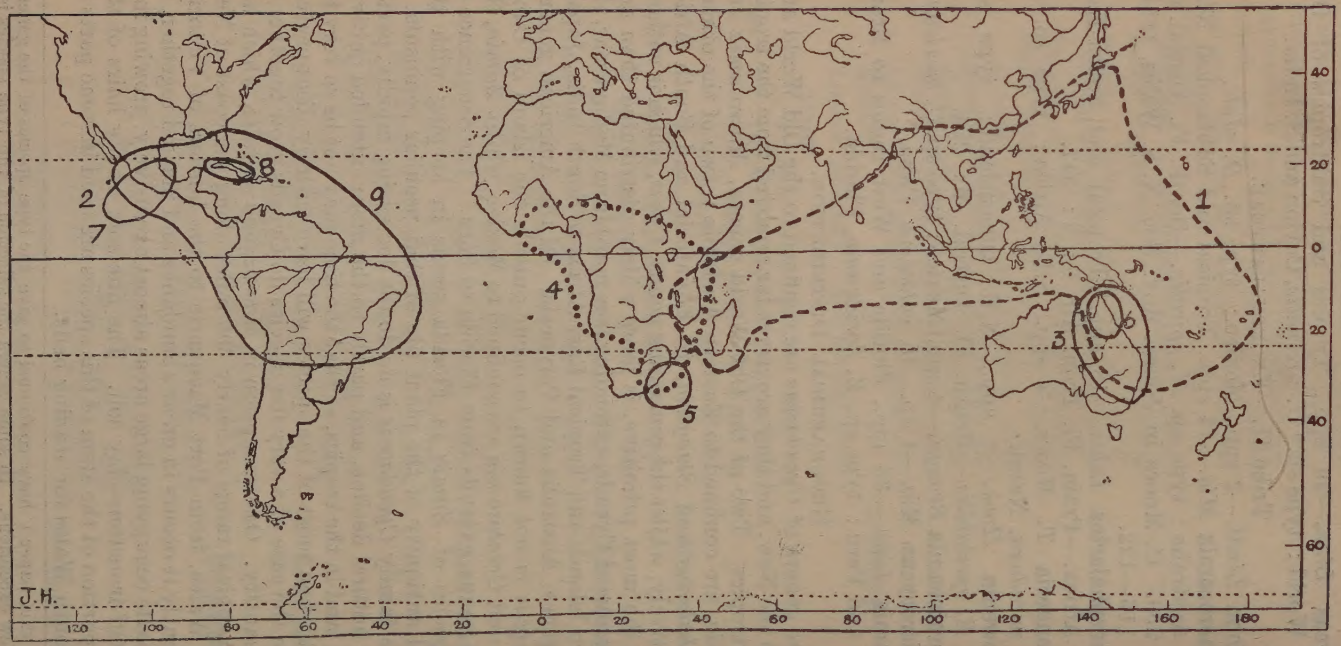
2. **Dioon** *Lindl.*—2 spp., Mexico ; type sp. *D. edule.*
3. **Macrozamia** *Miq.*—14 spp., Tropical and Subtropical N.E. Australia ; type sp. *M. spiralis.*—Benth. Fl. Austral. 6 : 250. C. Moore in Journ. Roy. Soc. N. S. Wales, 1884 : 115—122.
4. **Encephalartos** *Lehm.*—18 spp., Tropical and South-East Africa.—Prain, Fl. Trop. Afr. 6 : 2 : 347.
5. **Stangeria** *T. Moore.*—3 spp., S.E. Africa ; type sp. *S. paradoxa*, Natal.
6. **Bowenia** *Hook.*—2 spp., N.E. Queensland ; type sp. *B. spectabilis.*—Benth. Fl. Austral. 6 : 254.
7. **Ceratozamia** *Brongn.*—4 spp., Mexico ; type sp. *C. mexicana.*
8. **Microcycas** *Miq.*—1 sp., *M. calocoma*, Cuba.
9. **Zamia** *Linn.*—35 spp., Florida and West Indies to Brazil and Peru ; type sp. *Z. floridanum*, Florida.

Geographical Distribution.

Five genera of *Cycadaceae* are confined to the Old World and four to the New, and they are never far removed from the tropics or subtropics. Two of the Old World genera, *Macrozamia* and *Bowenia*, are confined to Eastern Australia ; two of the others, *Encephalartos* and *Stangeria*, to Equatorial and South Africa respectively, whilst the remaining genus, *Cycas*, which is without doubt the most primitive, is more widely distributed than any other genus of Cycads, extending (see map) from Madagascar, the Comoro Islands and Tropical East Africa to South India, Japan, Philippines, Australia and Polynesia. Of the American genera, *Microcycas* is not known to occur outside the island of Cuba, *Dioon* and *Ceratozamia* are confined to Mexico, whilst *Zamia*, the largest genus, extends from Florida to Peru. The occurrence of two species of *Zamia* in Florida seems in keeping with the general antiquity of the plant life of that peculiar peninsula.

The family *Cycadaceae* is no doubt decreasing rapidly, partly due to natural decline, and partly to the more extended cultivation of land in the tropics, so that the time may not be so very far distant when most of the species will have entirely disappeared. Only in the case of a very few species do Cycads grow together in any quantity. One exception is *Macrozamia spiralis*, which has a geographical range of nearly 300 miles along the coast of New South Wales, from Port Macquarie to the borders of Victoria. Frequently it occurs in great abundance and massed together, in some parts occupying large areas almost exclusively, growing in a poor stiff ironstone-clay soil. The fine soft woolly hairs of the upper portion of the stem of this species are used in some parts of New South Wales for stuffing beds.

* In this paper I have continued to give the type species of the genera, with a few exceptions. In some genera the selection of the type species is a simple matter, but in many, especially Linnean, the question will often remain a matter of opinion.



Distribution of the genera of CYCADACEAE.

1. CYCAS. 2. DIOON. 3. MACROZAMIA. 4. ENCEPHALARTOS. 5. STANGERIA. 6. BOWENIA. 7. CERATOZAMIA. 8. MICROCYCAS. 9. ZAMIA.

TAXACEAE.

Key to the Tribes and Genera.

Tribe I. Taxeae. Seeds partially or completely surrounded by an aril or with a fleshy resinous outer testa; anther-cells 2–8; pollen grains wingless.

Seeds partially or wholly invested by an aril; ovule solitary:

Stamens in a subsessile or stipitate cluster surrounded by bracts at the base; male flowers not in catkins; Northern Hemisphere (and Sumatra):

Seeds partially invested by a thick, fleshy, cupular, coloured aril; stamens supported on a stipe - - - - - 1. **Taxus.**

Seeds completely invested by a thin aril which becomes confluent with the woody testa; stamens in a subsessile cluster 2. **Torreya.**

Stamens in the axils of bracts arranged in short dense spikes; seeds completely invested by an aril; New Caledonia - - - 3. **Austrotaxus.**

Seeds without an aril, but the outer testa fleshy; male flowers in axillary clusters; anther-cells usually 3; ovules in terminal spikes or heads - 4. **Cephalotaxus.**

Seeds ?; male flowers in slender pendulous catkins; ovule solitary in the axil of a bract at the apex of the branchlet; imperfectly known Chinese genus - - - - 5. **Amentotaxus.**

Tribe II. Podocarpeae. Seeds with a dry testa; ovules erect or inverted; ovuliferous scale usually present, sometimes adnate to the integument of the ovule; anther-cells 2; pollen grains usually winged; leaves various.

*Branches never leaf-like:

Ovule erect or at length erect, the micropyle abaxial:

Ovuliferous scale absent, the ovule inserted directly on the carpellary scale; leaves triangular, small and imbricate - 6. **Phaerosphaera.**

Ovuliferous scale present:

Micropyle subbasal - - 7. **Dacrydium.**

Micropyle subapical - - 8. **Acmopyle.**

Ovule remaining inverted with the micropyle adaxial :
Sterile bracts at length fleshy and concrescent into a " receptacle " ; ovuliferous scale closely investing and adnate to the seed - - 9. **Podocarpus.**
Sterile bracts not fleshy or concrescent ; ovuliferous scale free from the seed coat :
Leaves linear, laxly arranged - 10. **Saxegothaea.**
Leaves short and triangular, imbricate - - - - 11. **Microcachrys.**
Branches flattened and leaf-like, bearing scale-leaves and flowers on their margins ; ovule erect - - 12. **Phyllocladus.

Excluded genus.—*Polypodiopsis* Carrière, Traité Général des Conifères, ed. 2. 710 (1867), is most likely a Proteaceous plant, and very probably *Bauprea Balansae* Brongn. & Gris. (see *Kew Bull*, 1920, 372).

Tribe I.—Taxeae.

1. **Taxus** *Linn.*—7 spp., N. Temperate Zone ; type sp. *T. baccata*, Europe to N. Persia, Algeria, Azores.
2. **Torreya** *Arn.* (*Tumion* Raf.).—5 spp., Eastern Asia, S. Unit. States ; type sp. *T. taxifolia*, Florida.
3. **Austrotaxus** *Compton* in Journ. Linn. Soc. 45 : 427, pl. 26 (1922).—1 sp., *A. spicata*, New Caledonia.
4. **Cephalotaxus** *Sieb. & Zucc.*—6 spp., Eastern India to Japan; type sp. *C. drupacea*, W. China to Japan.
5. **Amentotaxus** *Pilger* in Engl. Bot. Jahrb. 54 : 41 (1916).—1 sp., *A. argotaenia*, Hongkong to W. Hupeh, China.

Tribe II.—Podocarpeae.

6. **Phaerosphaera** *Archer.*—2 spp., *P. Hookeriana* (type), Tasmania ; *P. Fitzgeraldii*, New S. Wales.
7. **Dacrydium** *Soland.*—14 spp., Malaya, New Guinea, New Caledonia, New Zealand ; type sp. *D. cupressinum*, New Zealand.
8. **Acmopyle** *Pilger*, Monogr. Taxac. 117, fig. 24 (1903).—1 sp., *A. Pancheri*, New Caledonia.
9. **Podocarpus** *L'Hérit.*—about 65 spp., Tropics and Subtropics, mostly Southern Hemisphere ; type sp. *P. elongata*, S. Africa.
10. **Saxegothaea** *Lindl.*—1 sp., *S. conspicua*, Chile.
11. **Microcachrys** *Hk. f.*—1 sp., *M. tetragona*, Tasmania.
12. **Phyllocladus** *L. C. Rich.*—6 spp., Philippines to New Zealand ; type sp. *P. rhomboidalis*, Tasmania.

The *Taxaceae* have usually been included as a tribe in the more comprehensive family " Coniferae", and they are so placed by Bentham & Hooker and by Engler & Prantl. They were

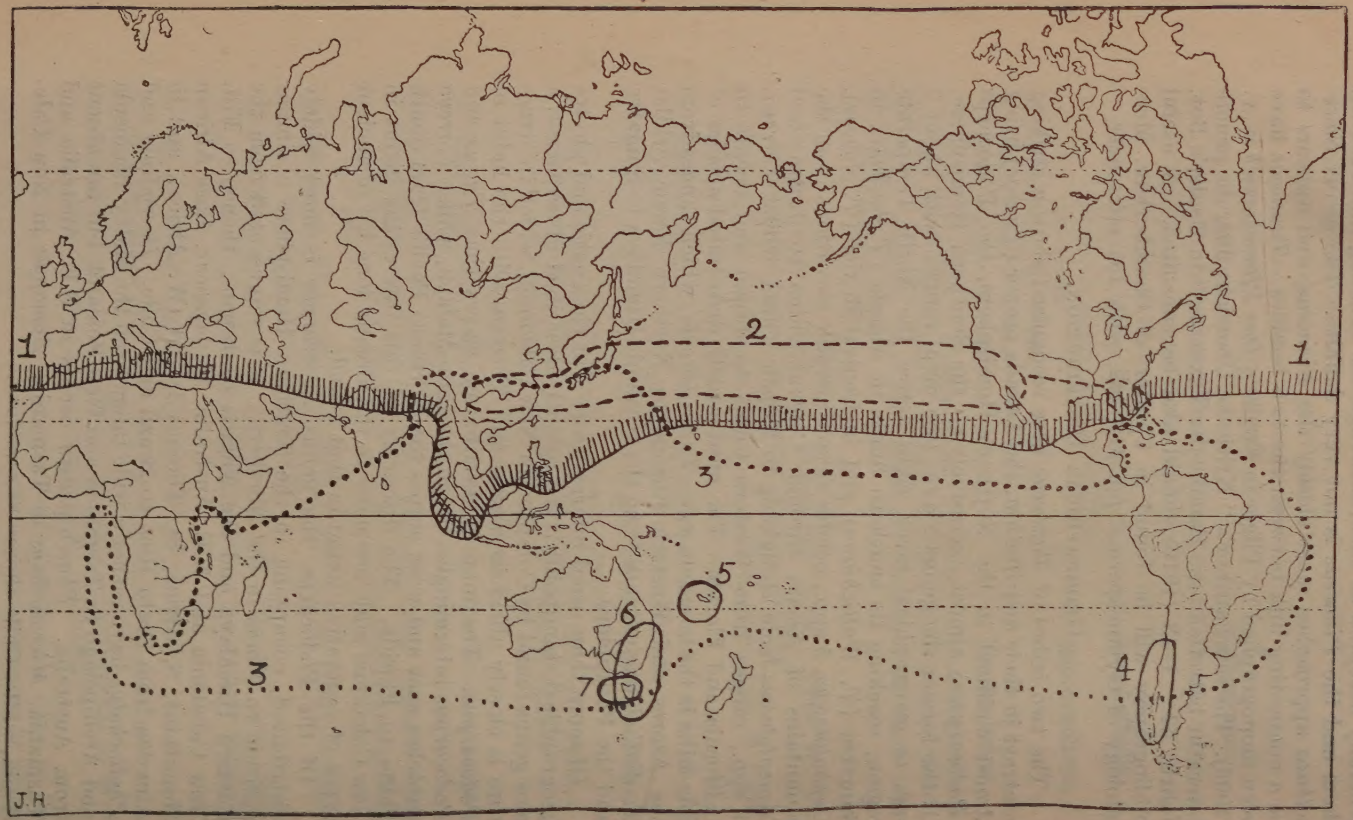
regarded as a distinct family by Lindley, however, and are now generally accepted as such, although the dividing line between them and the *Pinaceae* is not very definite. The genus *Saxegothaea* approaches most closely the *Pinaceae*, and appears to be a connecting link between the two families. *Taxaceae* have been monographed by Pilger in Engler's *Das Pflanzenreich* iv. v. (1903). The same author's " Kritische Übersicht über die neuere Literatur betreffend die Familie der Taxaceae " in Engler's Bot. Jahrb. 54 : 1–43 (1916) should also be consulted. A useful bibliography will be found in Coulter & Chamberlain, Morphology of Gymnosperms, pp. 313–362, with 181 references.

Geographical Distribution.

The two tribes of *Taxaceae* here recognised show a striking contrast in their distribution, the Taxads proper (*Taxeae*) being almost confined to the Northern Hemisphere, the Podocarps (*Podocarpeae*) almost exclusively to the Southern Hemisphere. Of the former the genus *Taxus* (see map) ranges, with about 7 spp. or geographical races, right across the North Temperate region, reaching its southern limits in Algeria (*T. baccata*), in Sumatra (*T. Wallichiana*), and in Central Mexico (*T. globosa*). *Cephalotaxus*, 5 spp., occurs at considerable elevations from the mountains of Assam through Central China to Japan, and *Amentotaxus* from Hongkong to Hupeh, China, whilst *Torreya*, 5 spp., ranges from Western China to Japan and occurs in California and Florida. The most widely distributed species of this tribe is the common yew, *Taxus baccata*, which ranges from the Azores and Western Europe to Northern Persia, whilst *T. Wallichiana* extends from the Kashmir Himalaya to Sumatra and the Philippines.

Of more than usual interest from a phylogenetic and phytogeographical standpoint is the recently described *Austrotaxus*, a new genus found by Compton in New Caledonia, which in structure is closely allied to *Taxus* and *Torreya*, with the habit of *Podocarpus*. The map of distribution shows that *Taxus* and *Podocarpus* intermingle only in the Indo-Malaya, whilst *Torreya* stretches east and west across the Northern Pacific from South China to Florida. The discovery of this interesting genus in New Caledonia adds one more to the already long list of ancient types of vegetation found in that island.

Of the Podocarps, the genus *Podocarpus* is most widely distributed, occupying in the Southern Hemisphere a similar position to *Pinus* in the Northern ; it is represented from the Eastern Himalaya and the Nilgiris to Japan ; thence to Fiji, New Caledonia and N.E. Australia, Madagascar, East African Mountains, S. Africa, St. Thomas Island (W. Africa), and in America from Costa Rica to Brazil and Chile. *Dacrydium* and *Phyllocladus* have rather a wide range from the Malay Peninsula and Archipelago to Tasmania and New Zealand, but are absent from Australia. *Phaerosphaera* occurs in S.E. Australia and Tasmania, *Microcachrys* in Tasmania, *Acmopyle* in New Caledonia, whilst Chile claims *Saxegothaea*.



Distribution of certain genera of TAXACEAE.
1. Southern limits of TAXUS and tribe *Taxeae* (except AUSTROTAXUS in New Caledonia). 2. TORREYA. 3. PODOCARPUS. 4. SAXEGOTHAEA. 5. ACMOPYLE. 6. PHAEROSPHAERA. 7. MICROCACHRYS.

PINACEAE.

Key to the Tribes.

Subfamily I. **Abietoideae.** Leaves and cone-scales spirally arranged; ovuliferous scale free from or adnate to the subtending bract.

Cone-scales spirally imbricate; ovuliferous scale free from the subtending bract or only slightly adnate at the base; ovules 2 to each scale, inverted, with the micropyle adaxial; seeds usually samaroid - - - - - Tribe I. Abieteae.

Cone-scales spirally closely imbricate; ovuliferous scale very thin and completely adnate to the subtending bract, not visible externally; ovules 1–6 to each scale, inverted, inserted collaterally about or below the middle of each scale; seeds laterally winged or not winged, never samaroid - - Tribe II. Araucarieae.

Cone-scales spirally arranged but not closely imbricate; ovuliferous scale completely adnate to the subtending bract and much thickened and conspicuous externally, sometimes nearly obscuring the bract; male cones spicate, umbellate or paniculate; ovules 2–6, erect or inverted; seeds more or less narrowly and laterally winged - - Tribe III. Taxodieae.

Subfamily II. **Cupressoideae.** Leaves and cone-scales opposite and decussate or in whorls of 3, 4, 6 or 8; ovuliferous scale completely adnate to the bract, often totally obscuring it.

Fertile cone-scales in more than one series, crowded - - - Tribe IV. Cupresseae.

Fertile cone-scales in a single whorl of 4, 6 or 8, rarely slightly 2-seriate, woody, more or less valvate - - Tribe V. Callitreae.

Key to the Genera.

Subfamily I.—Abietoideae.

Tribe I.—Abieteae.

§Leaves all more or less of one kind:

*Branches all of one kind, of unlimited growth; leaves not in fascicles - - - - - - Subtribe Picineae.

Branches rough and muricate with the persistent decurrent stalks of the fallen leaves; scales persistent on the cone axis:

Branchlets very rough with the closely set rather long leaf bases; persistent bud scales at the base of each season's growth usually very conspicuous; anther-connective produced into a scale-like appendage - - 1. **Picea.**

Branchlets slightly rough with the lax short leaf-bases; persistent bud scales not conspicuous; anther-connective merely umbonate beyond the cells - - - - - 2. **Tsuga.**

Branchlets comparatively smooth, marked only with the scars of the fallen sessile leaves:

Male cones umbellate; leaves keeled on both surfaces - - 3. **Keteleeria.**

Male cones solitary or racemose:

Cone-scales deciduous - - 4. **Abies.**

Cone-scales persistent; leaf buds beech-like - - - 5. **Pseudotsuga.**

**Branches of two kinds, some elongated and sparsely leafy, others abbreviated and bearing fascicles of leaves - - - - - Subtribe LARICINEAE.

Leaves evergreen; cone-scales at length deciduous - - - 6. **Cedrus.**

Leaves deciduous:

Male cones solitary, catkin-like; female cone-scales persistent; pollen grains not winged - - - - - 7. **Larix.**

Male cones umbellate; female cone-scales deciduous; pollen grains winged; buds conspicuously awned - - - - 8. **Pseudolarix.**

§§Leaves and branchlets of two kinds, small membranous scale leaves on the long shoots, needle-like leaves on the short shoots - - - - Subtribe PININEAE.

Leaves needle-like, in fascicles of 2–6 - - - - - - 9. **Pinus.**

Tribe II.—Araucarieae.

Monoecious; seeds not adnate to the ovuliferous scale:
- Leaves large, broad, with numerous parallel nerves; ovule usually 1; Malaya to Polynesia and New Zealand — 10. **Agathis.**
- Leaves linear, acute, spreading in one plane; ovules 2–4; China, Japan — 11. **Cunninghamia.**
- Leaves small, triangular, closely imbricate; ovules 2; Formosa — 12. **Taiwania.**

Dioecious; seed adnate to the ovuliferous scale — 13. **Araucaria.**

Tribe III.—Taxodieae.

Leaves normal; no phylloclades present:
- Male cones spicate:
  - Leaves hard and always persistent:
    - Seeds pendulous; cone-scales not lobed:
      - Cones globose; anther-cells 2 — 14. **Athrotaxis.**
      - Cones oblong-ellipsoid; anther-cells 4–5 — 15. **Sequoia.**
    - Seeds erect; cone-scales laciniate-lobate — 16. **Cryptomeria.**
  - Leaves soft and usually deciduous; cones oblong-ellipsoid — 17. **Glyptostrobus.**
- Male cones paniculate; leaves soft, usually deciduous; cones globose, hard, ball-like — 18. **Taxodium.**

Leaves small, scattered, scale-like, with decurrent, large, linear-acicular, subverticillate phylloclades; monotypic Japanese genus — 19. **Sciadopitys.**

Subfamily II.—**Cupressoideae.**

Tribe IV.—Cupresseae.

Cone-scales woody, joined only at the base — Subtribe Thuineae.
- Flowers dioecious; cone-scales thin; Southern Hemisphere:
  - Seeds 2-winged; S. America — 20. **Fitzroya.**
  - Seeds 3-winged; Tasmania — 21. **Diselma.**

Flowers monoecious, very rarely

dioecious ; cone-scales thick ; mainly Northern Hemisphere :
Cone-scales radiating, truncate and peltate, forming a globose or ovoid head :
Leaves subequal, closely imbricate ; seeds usually more than 2 - - - - - 22. **Cupressus.**
Leaves in one rank much larger than in the other, the smaller ones almost scale-like ; seeds 2 to each scale, 2-winged - - - - - 23. **Fokienia.**
Cone-scales mostly ascending, more or less oblong or clavate, obtuse or rounded at the apex, often with a dorsal horn-like bract :
Cone-scales more than 6 ; seeds equally winged or not winged - - - - - 24. **Thuya.**
Cone-scales 6, only the middle ones fertile ; seeds obliquely winged at the apex - - - 25. **Libocedrus.**
Cone-scales at length fleshy and berry-like, concrescent - - - Subtribe JUNIPERINEAE.
One genus in the Northern Hemisphere - - - - - 26. **Juniperus.**

Tribe V.—CALLITREAE.

Branchlets angular ; cones paniculate, their axes produced above the base of the scales :
Fertile cone-scales 6–8, usually unequal, pointed or acute ; Australasia - - - - 27. **Callitris.**
Fertile cone-scales 6, equal ; West Australia - - - 28. **Actinostrobus.**
Fertile cone-scales 4, equal, truncate ; E. and S.E. Africa - 29. **Widdringtonia.**
Branchlets compressed ; cone axis not produced beyond the base of the 4 bracts ; N. Africa- - - 30. **Tetraclinis.**

Tribe I.—ABIETEAE.

1. **Picea** *Link.*—40 spp., North Temperate Zone.
2. **Tsuga** *Carr.*—10 spp., Asia, N. America ; type sp. *T. Sieboldii*, Japan.
3. **Keteleeria** *Carr.*—5 spp., China, Japan, Formosa ; type sp. *K. Fortunei*, Japan.
4. **Abies** *Link.*—33 spp., North Temperate Zone.

5. **Pseudotsuga** *Carr.*—2 spp., N. America; type sp. *P. mucronata* (*P. Douglasii*), Rocky Mts. and Coast Ranges from 54° N. to Mexico.
6. **Cedrus** *Tourn.* ex *Loud.*—4 spp., Atlas Mtns. to Himalaya; type sp. *C. Libani*, Asia Minor.
7. **Larix** *Mill.*—15 spp., North Temperate Zone; type sp. *L. europaea*, Switzerland.
8. **Pseudolarix** *Gord.*—1 sp., *P. Kaempferi*, E. China.
9. **Pinus** *Linn.*—70 spp., Temp. Northern Hemisphere, West Indies, Central America; type sp. *P. sylvestris*, Europe.

Tribe II.—Araucarieae.

10. **Agathis** *Salisb.*—15 spp., Malaya to New Zealand, Polynesia; type sp. *A. loranthifolia*, Mal. Penins. to Philippines.
11. **Cunninghamia** *R. Br.*—1 sp., *C. sinensis*, W. China to Japan.
12. **Taiwania** *Hayata* in Journ. Linn. Soc. 37 : 330, t. 16 (1906). —1 sp., *T. cryptomerioides*, Formosa.
13. **Araucaria** *Juss.*—15 spp., New Guinea, East Australasia, S. America; type sp. *A. imbricata*, Chile.

Tribe III.—Taxodieae.

14. **Athrotaxis** *D. Don.*—3 spp., Tasmania; type sp. *T. laxifolia.*
15. **Sequoia** *Endl.*—2 spp., Pacific N. America; type sp. *S. sempervirens*, S. Oregon to California.
16. **Cryptomeria** *D. Don.*—1 sp., *C. japonica*, West and South China to Japan.
17. **Glyptostrobus** *Endl.*—1 sp., *G. heterophylla*, S. China.
18. **Taxodium** *L. C. Rich.*—1 sp., *T. distichum*, S.E. United States.
19. **Sciadopitys** *Sieb. & Zucc.*—1 sp., *S. verticillata*, Japan.

Tribe IV.—Cupresseae.

20. **Fitzroya** *Hook. f.*—1 sp., *F. patagonica*, Chile and Patagonia.
21. **Diselma** *Hook. f.*—1 sp., *D. Archeri*, Tasmania.
22. **Cupressus** *Linn.*—14 spp., North Temperate Zone; type sp. *C. sempervirens*, Mediterranean to Western India.
23. **Fokienia** *A. Henry & Thomas* in Gard. Chron. 49 : 67, ff.— 1 sp., *F. Hodginsii*, China.
24. **Thuya** *Linn.*—about 12 spp., North Temperate Zone; type sp. *T. occidentalis*, N.E. Asia, N. America.
25. **Libocedrus** *Endl.*—9 spp., S.W. China to New Zealand; W. Temperate South Amer.; type sp. *L. Doniana*, New Zealand.
26. **Juniperus** *Linn.*—28 spp., Northern Hemisphere, Mts. of E. Africa; type sp. *J. communis*, widely spread in the North Temperate Zone.

Tribe V.—CALLITREAE.

27. **Callitris** *Vent.* (*Callitropsis* Compton)—18 spp., Australasia ; type sp. *C. rhomboidea*, Australia.

28. **Actinostrobus** *Miquel*—2 spp., Western Australia ; type sp. *A. pyramidalis.*

29. **Widdringtonia** *Endl.*—5 spp., Africa ; type sp. *W. juniperoides*, S. Africa.

30. **Tetraclinis** *Masters* in Journ. Linn. Soc. 30 : 14 (1893).—1 sp., *T. articulata*, N. Africa, Malta, Carthagena.—See Sommier in Bull. Soc. Bot. Ital. 1906 : 115, for records in Malta and Carthagena.

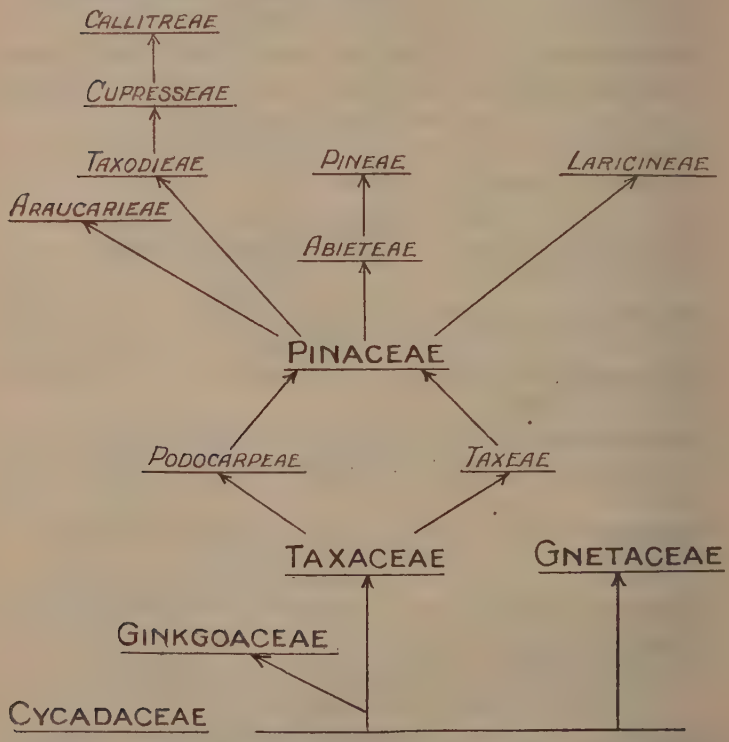
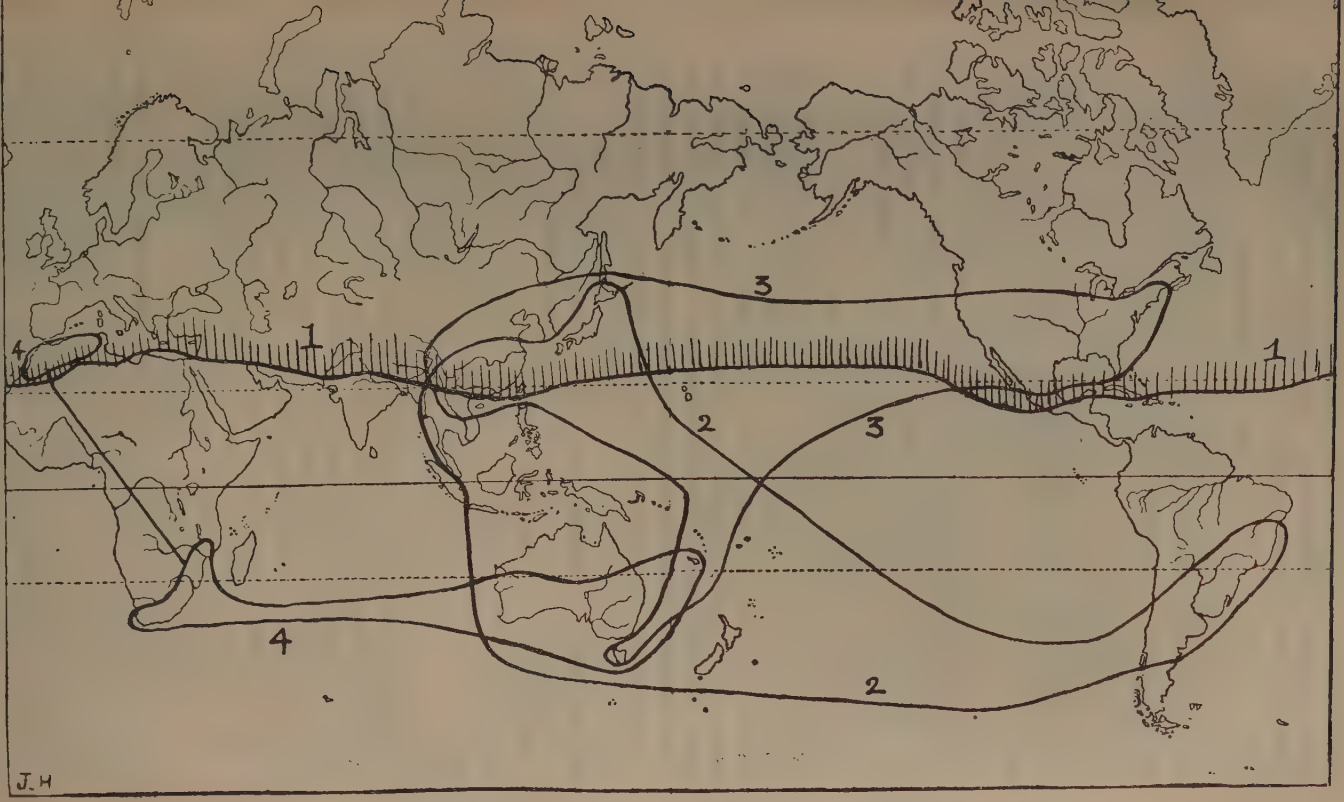


Diagram showing the approximate relationships of the principal groups of living Gymnosperms. The *Callitreae*, *Pineae* and *Laricineae* are regarded as the most recently evolved of the *Pinaceae.*

For a considerable period the family *Pinaceae* engaged the attention of the late Dr. Masters, and his sound views on the genera are reflected in the key given above. The literature relating to the family is so vast that no useful purpose would be served in enumerating it here. Extensive bibliographies will be found in Eichler in Engler and Prantl, Naturl. Pflanzenf. 2. 1 : 28 (1889) ; Penhallow, Manual of North American Gymno-



Distribution of tribes of PINACEAE (except CUPRESSEAE).

1. Southern limits of ABIETEAE. 2. ARAUCARIEAE.
3. TAXODIEAE. 4. CALLITREAE.

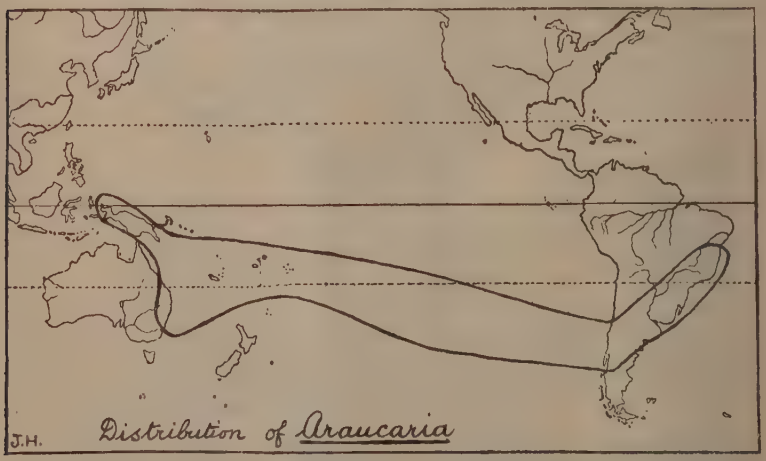
sperms (1907), p. 363 ; Scott, Studies in Fossil Botany (1909) ; Coulter and Chamberlain, Morphology of Gymnosperms (1910) pp. 220–312, and Seward, Fossil Plants, vol. 4.

Geographical Distribution.

The map (see p. 63) shows to a striking degree the great intercontinental connections between the Conifer floras of South America and Australasia (*Araucarieae*), Australia and South Africa (*Callitreae*), and S.E. China and the United States of America (*Taxodieae*).

Tribe *Abieteae* is entirely confined to the Northern Hemisphere (see map), ranging from sea-level to the limits of phanerogamic vegetation on high mountains and towards the Pole. Very few specimens of this tribe enter the tropics, and then only at high elevations. In the Old World the tribe reaches its southern limits in the Canaries (the endemic *Pinus canariensis*), the Atlas Mts. of Morocco and Algeria (*Cedrus atlantica*), the Southern Slopes of the Himalaya, and in the New World on the high plateaux of Central America.

The principal genera, *Picea*, *Tsuga*, *Abies*, *Larix* and *Pinus*, have a very wide distribution in the northern parts of the Old and New Worlds. The remainder are comparatively small and restricted in their range, *Cedrus* showing an interesting link between the coniferous flora of the Atlas Mts., Cyprus, Asia Minor and the North West Himalaya. Indeed, Hooker considered the four species now generally recognised as occurring in these regions respectively to be little more than geographical races of one, so closely are they related. *Keteleeria* and *Pseudo-*



larix are confined to China, the former also in Formosa, whilst *Pseudotsuga* has a long latitudinal range in the mountains of Pacific N. America.

Tribe *Araucarieae* is absent from the Old World west of the Malay Peninsula and Yunnan, and in the New World is found only in S. America. *Agathis*, the largest genus, ranges from the

Malay Peninsula and the Philippines through Eastern Australia to Fiji and New Zealand ; *A. loranthifolia*, the most widely spread species, from the Malay Peninsula to Java, Borneo and the Philippines. The monotypic *Cunninghamia* occurs from Western China to Japan, and *Taiwania* is a curious Formosan genus. *Araucaria* shows an ancient connection between the coniferous floras of Australia and South America.

Tribe *Taxodieae* is rather scattered and is found in both hemispheres. *Athrotaxis* is the only genus in the Southern Hemisphere and is confined to Tasmania. *Sequoia* is confined to Pacific, and *Taxodium* to Atlantic North America, whilst *Cryptomeria* is common to China and Japan, and *Glyptostrobus* endemic to South China.

Tribe *Cupresseae* has also a very scattered distribution, *Cupressus*, *Juniperus*, and *Thuya* occurring throughout the North Temperate Zone, *Juniperus* entering the Northern Tropic only in the East African mountains. *Libocedrus* has a wide range through Yunnan and Formosa, New Guinea, New Caledonia, New Zealand, California, and West Temperate South America, the remaining genera being restricted, *Fitzroya* to Temperate South America, *Diselma* to Tasmania, and *Fokienia* to S. China.

Except for the monotypic *Tetraclinis* in the Moroccan and Algerian Atlas, tribe *Callitreae* is found only in the Southern Hemisphere, *Callitris* occurring in Australia and New Caledonia, *Actinostrobus* in Western Australia, and *Widdringtonia* in S.E. Tropical and South Africa.

Most of the species of *Pinaceae* are restricted in their distribution. Examples of wide range, however, are : *Juniperus communis*, throughout the N. Temp. Zone including Greenland ; *Juniperus virginiana* and *Picea canadensis*, widely spread in North America ; *Abies pectinata*, Spain to S.W. Russia ; *Pseudotsuga mucronata*, an extended north to south range in West North America ; *Larix americana*, Labrador to Alaska ; *Cupressus sempervirens*, West Europe to Western India. Examples of extremely limited range are afforded by *Cupressus macrocarpa*, the Monterey Cypress, which inhabits a small stretch of the Californian coast south of the Bay of Monterey, not more than two miles long and two hundred yards wide. Sargent (Silva, 10, 104) expresses the opinion that, on account of the vigorous constitution which this tree shows in its ability to withstand long exposure to gales and saline spray on the cliffs of the Pacific Ocean, and its unusual power of adapting itself to very different climatic conditions under cultivation, it once occupied a much larger area of Central California, and has been restricted to the shore of Carmel Bay by the gradual drying of the climate or by fire during comparatively recent times. Another local species is *Cupressus Macnabiana*, which occupies only a few dry hill slopes near Clear Lake, California. A striking example of a pine confined to a small group of oceanic islands is *Pinus canariensis*, the dominant forest tree in the Canaries. Its nearest relatives are found in Central America.

Distribution of GNETACEAE.

1. EPHEDRA. 2. GNETUM. 3. WELWITSCHIA. The genera are entirely isolated from one another. The area of *Welwitschia* is much enlarged to indicate its position.

V.—NOTES ON TASMANIAN HEPATICS.

W. H. PEARSON.

Mr. W. A. Weymouth, of Hobart, Tasmania, who attained his eightieth birthday on the 24th of September last,* sent me some time ago a rich collection of Tasmanian Hepatics to name, with the intention of distributing sets from his extensive gatherings, for charitable purposes. The specimens are large and in very good condition, and reflect great credit on this veteran hepaticologist.

In the collection there are three species which so far as I know are new, descriptions of which follow. In addition to these, there are two varieties of the variable *Lophocolea heterophylloides* Nees, which species seems to be very abundant, and widely distributed in that country, to judge by the numerous specimens received.

The genus *Lophocolea* is remarkably well represented in Tasmania; Mr. L. Rodway enumerates no less than 42 species, whilst the number recorded by Stephani for all Europe, Asia and North America is only 14. To obey the laws of nomenclature, I should give a short diagnosis in Latin for the new species, but I follow Prof. Evans, who defies these laws, describing at length all the minute characters of his new species in English; and it is a pleasure to be able to identify his species from his lucid descriptions. The *Hepaticae*, although so small, have so many organs to describe; their stems, rhizoids, leaves, underleaves, bracts,

* 24th September, 1921.—This paper with the collection was offered to Kew by Mr. Pearson shortly before his death on the 19th April, 1923, but it has only recently been received for publication.

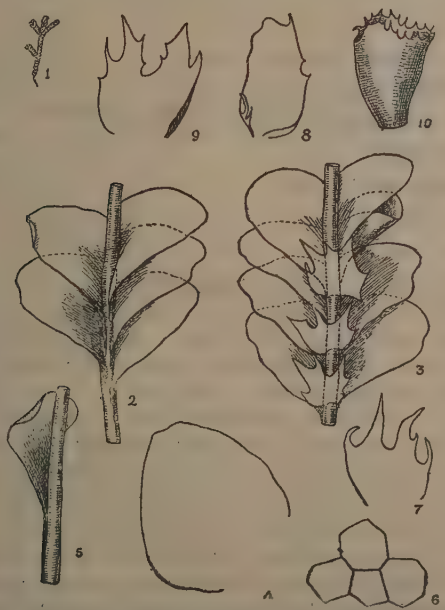
perianths, capsules, spores, elaters and male flowers, that without a clear description of each particular organ, it is difficult, if not impossible, to recognise the same.

The following is a list of species sent :—

Hymenophytum phyllanthus (*Hook.*) *Dum.*
Symphogyna obovata (*Tayl.*) *Gott., Lindenb. & Nees.*
Symphyomitra Drummondii (*Mitt.*) *Spruce.*
Cuspidatula monodon (*Tayl.*) *St.*
Plagiochila radiculosa *Mitt.*
P. biserialis *L. et L.*
P. deltoidea *Lindenb.*
P. fasciculata *Lindenb.*
P. retrospectans *Nees.*
P. recurvifolia *St.* A very beautiful species.

Lophocolea macrostipula *St.* A very distinct species, the concave rotund underleaves, with a lunate sinus, and a small tooth at the base of the two segments distinguish it from any of the forms of *L. heterophylloides* Nees, of which some have much larger underleaves.

L. heterophylloides *Nees* (Numerous forms). Stephani says fruit rare and does not give a description of it. One of Mr. Weymouth's specimens was covered with capsules. Pedicel



L. heterophylloides var. decurrens.

Fig. 1. Plant ½ nat. size. 2. Portion of stem, antical view (× 8). 3. Ditto postical view (× 8). 4, 5. Leaves (× 12). 6. Portion of leaf (× 145). 7. Underleaf (× 12). 8. Bract (× 8). 9. Bracteole (× 8). 10. Perianth (× 8).

8 to 10 mm. long; capsule ·75 mm., dark brown; valves, through transmitted light, reddish brown; spores ·01 mm., smooth, light brown; elaters bispiral, about 12 turns, ·125 mm. long × ·01 mm. broad.

Lophocolea heterophylloides *Nees* var. **decurrens** *Pears.* Distinguished from type by its large, very decurrent leaves, some stems appearing to be winged, and its large underleaves.

Dimensions. Stems 2·53 cm. long, ·3 mm. diam., with leaves 3 mm. wide; leaves 3 mm. long × 2·5 mm. broad, 2·5 mm. × 2·5 mm., 2·5 mm. × 2 mm., 2 mm. × 1·75 mm.; cells ·04 mm.; underleaves 1·5 mm. high × 1 mm. broad, 1·5 mm. × 1·5 mm., 1·25 mm. × 1 mm.; bracts 2 mm. long × 1 mm. broad, 2 mm. × 1·25 mm.; bracteole 2 mm. high × 1·5 mm. broad; perianth 2 mm. long × 1·25 mm. broad. (See Fig. 1, p. 67).

Lophocolea heterophylloides *Nees* var. **macrocalyx** *Pears.* Hardly to be separated from var. *decurrens*; remarkable for its very large involucres.

L. Forsythiana *St.*

L. macroloba *St.*

L. Weymouthii *St.*

L. submarginata *Tayl.*

L. leucophylla *Tayl.*

Chiloscyphus fissistipus *Tayl.*

C. Moorei *St.*

C. laxus *Mitt.*

Adelanthus falcatus (*Hook.*) *Mitt.*

Lepicolea scolopendra (*Hook.*) *Dum.*

Lepidolaena magellanica (*Lam.*) *Schiffn.*

Radula buccinifera *Tayl.*

Frullania deplanata *Mitt.*

F. diplota *Tayl.*

F. falciloba *Tayl.*

Frullania (Trachycolea) reptans *Mitten.* Dioicous. Small; pale to reddish brown in colour; in thin flat patches on rocks and trees. Stem composed of minute cells, frontally compressed, 6 × 8 cells, inner same as cortical; prostrate; irregularly pinnate or bipinnate; rhizoids few, dull white. Leaves: lobe horizontal (90°) or slightly ascending (80°), subopposite, convex, antical (upper) margin extending beyond the stem, oblong-orbicular, broader than high, entire, antical margin slightly ampliate, apex rotundate; lobule galeate, lower part on a level with the lobe, mouth distinct; stylus small, triangular or lanceolate, often wanting; cells small, irregularly quadrate, walls thick, with nodules at the corners, no trigones. Underleaves approximate or distant, rather wider than the stem, obcuneate, angular to rotund, bifid to about $\frac{1}{3}$rd, with or without a notch on exterior of segments at the middle. Bracts larger than the leaves; lobe oval; apex rotundate; lobule about

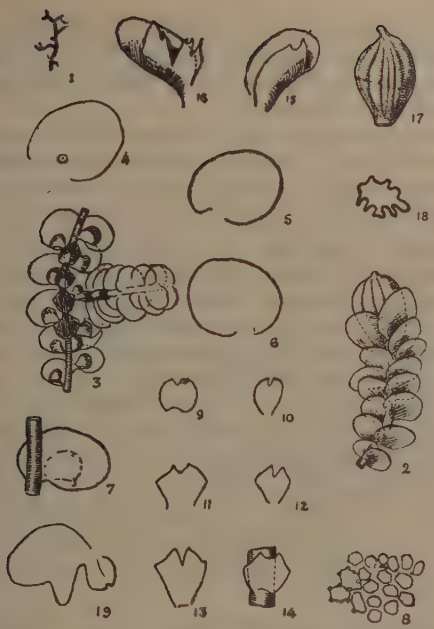


Fig. 1. Plant ½ nat. size. 2. Portion of stem, with perianth, antical view (× 12). 3. Ditto, with amentula, postical view (× 12). 4-7. Leaves (× 25). 8. Portion of leaf (× 145). 9–14. Underleaves (× 25). 15. Bract (× 12). 16. Bract and bracteole (× 12). 17. Perianth (× 12). 18. Cross-section of perianth (× 12). 19. Male bract and bracteole, explanate (× 25).

⅔rds smaller, elliptic, acuminate, with one smaller acuminate segment. Bracteole connate with the bract, oblong-quadrate, bifid, trifid or quadrifid. Perianth projecting about ½ beyond the bracts, oval, 9-plicate, with 2 antical, 2 lateral and 5 postical keels, deep, obtuse, smooth or uneven, beak long. Androecia on short lateral branches, catkin-like with 6–8 pairs of bracts, rarely capitate with four pairs of bracts; perigonial bracts semi-rotund, apex rotundate, lobule short, narrowly ovate, obtuse.

Dimensions. Stems 2·5 cm. long; ·1 mm. diam., with leaves 1 mm. wide; leaves, lobe ·55 mm. × ·45mm., lobule ·1 mm × ·1 mm.; cells ·02 mm.; underleaves ·2 mm. × ·2 mm.; bract, lobe 1 mm. × ·6 mm., lobule ·9 mm. × ·4 mm.; bracteole ·75 mm. × ·3 mm.; perianth 1 mm. × ·75 mm.

These specimens were determined by Stephani as *Frullania pentapleura* Tayl. *F. pentapleura* Tayl., however, has perianths with five (never more) keels, which, though always present, are sometimes not well developed; the bract-lobule is entire and the inflorescence dioicous (not monoicous as stated by Stephani). As Weymouth's specimens did not agree with these characters and I could not reconcile the plants with the descriptions of *F. reptans* Mitt. nor of any other published species of *Frullania*, I concluded they belong to an undescribed species. Through the kindness of the authorities at Kew, however, I have had the

opportunity of examining the original specimens of *F. reptans* Mitt., with which they entirely agree. I add a fuller, and I believe a more correct, description of the species than the ones given by Mitten and Stephani.

Mitten's description is very short and vague. He says underleaves 4-toothed. Whilst varying considerably on the same stem, they cannot be described as 4-toothed, although Bastow (Proc. Roy. Soc. Tasm. 1887, t. 29) figures them as quadrifid. Mitten describes the keels of the perianths as toothed, but they are smooth. Stephani says stems 10 cm. long, an evident slip for 10 mm.; interior margin of bract-lobule denticulate (I have seen no such character); androecia small, capitate, 2 pairs of bracts (they are usually long, 5 and 6 pairs of bracts, although occasionally shorter).

Rodway (Proc. Roy. Soc. Tasm. 1916, 137) states that *F. reptans* is rather more robust than *F. pentapleura* Tayl. *F. falsa* St., also from Tasmania, he reduces to a synonym of *F. pentapleura* Tayl., with a remark that it is a depauperated form growing on dry rocks. Stephani describes it (Syn. Hepat. iv. 413) with perianth obovato-oblong, 12-plicate, bracts falcato-ligulate, lobule lanceolate (evidently a very different species from *F. pentapleura* Tayl.).

Symphyomitra Weymouthii *Pearson* n. sp. Sterile. Small; pale green in colour, whitish below; loosely caespitose. Stem prostrate, simple or slightly branched, very tender, antical side plane, postical rounded, 8 × 6 and 6 × 4 cells, cortical cells

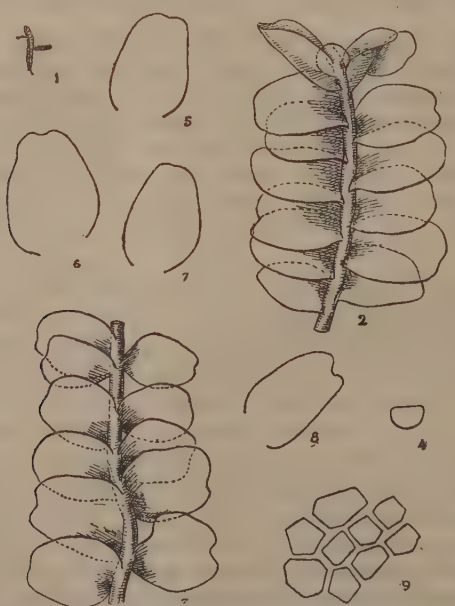


Fig. 1. Plant ½ nat. size. 2. Portion of stem, antical view (× 12). 3. Ditto, postical view (× 12). 4. Cross-section of stem (× 25). 5-8. Leaves (× 12). 9. Portion of leaf (× 145).

similar to the inner ; branches lateral, slightly postical, arising from below leaf, radiculose, rhizoids hyaline, straight, ascending to apex of stem, flagelliferous, flagellae postical, microphyllous, radiculose. Leaves horizontally inserted, imbricate, slightly concave or plane, broadly ovate, oblong-ovate or roundish-oblong-quadrate, entire or retuse, upper (postical) margin extending to middle of stem, lower leaves smaller, bifid ; cells medium size, 4-, 5- and 6- sided ; walls thin, no trigones.

Dimensions. Stems 1·3 to 2·5 cm. long ; diam. ·2 mm., with leaves 2·25 mm. wide ; leaves 1·5 mm. × 1 mm., 1·25 mm. × ·9 mm., 1·1 mm. × ·8 mm. ; cells ·04 mm. × ·03 mm., ·035 mm. × ·035 mm.

I know of no species with which this can be compared.

Lophocolea bicuspidata *Pearson* n. sp. Monoicous ; medium size, dark to dull green in colour, loosely caespitose. Stems irregularly and sparingly ramose. Leaves subopposite, horizontal (90°) to patent-divergent (70°), antical margin long-decurrent, straight or slightly curved (70°), postical (upper) margin curved, long-triangular, margin entire, apex 5 to 6 times narrower than the base, bicuspidate, segments acuminate, upper larger than lower, sinus rounded ; texture delicate, cuticle slightly papillose ; cells medium size, quadrate, walls thick, trigones minute. Underleaves large, connate with both leaves or one only, rarely free, broadly cuneate or subquadrate, rather

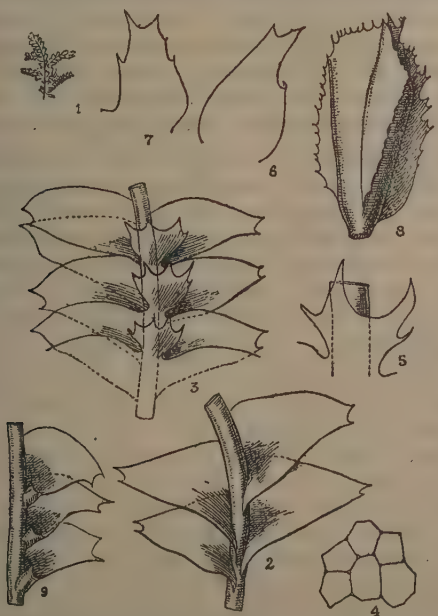


Fig. 1. Plant ½ nat. size. 2. Portion of stem, antical view (× 12). 3. Ditto, postical view (× 12). 4. Portion of leaf (× 145). 5. Underleaf (× 25) 6. Bract (× 12). 7. Bracteole (× 12). 8. Perianth (× 12). 9. Male bracts (× 12).

broader than high, bifid to about $\frac{1}{3}$rd, sinus rounded ; segments with two or more teeth on their exterior sides, the upper larger than the lower, sometimes the uppermost segment is large, so that the underleaf might be described as quadrifid. Inflorescence terminal on chief stem or short branches. Bracts oblong-ovate, bifid to $\frac{1}{4}$th, margin entire or with a single small tooth near the middle. Bracteole connate with adjoining bract or bracts, oblong-quadrate, bifid to about $\frac{1}{4}$th, with two or 3 small teeth on the margin. Perianth projecting a little beyond the bracts, oblong, trialate, wings broad, spinulose-dentate, mouth spinulose-dentate. Male branches often delicate, bracts semirotund, apex bicuspidate, lobule very small, free margin acute.

Dimensions. Stem 2·5 cm. long, ·25 mm. diam., with leaves, 3 mm. wide ; leaves 1·75 mm. long × 1·25 mm. wide at base, ·2 mm. wide at apex ; cells ·03 mm. ; underleaves ·55 mm. high × ·65 mm. broad, ·65 mm. high × ·75 mm. broad ; bracts 1·75 mm. long × 1 mm. wide at base, ·3 mm. at apex, 2·25 mm. long × 1·25 mm. wide at base, ·4 mm. wide at apex ; bracteole 1·5 mm. long × ·75 mm. wide ; perianth 2·5 mm. long × 1·5 mm. wide.

Lophocolea decurva Mitten, according to Stephani's description, has ovate leaves and concave underleaves. *Lophocolea trialata* Gottsche has leaves broadly triangular, hardly longer than broad, large trigones, bracts minutely denticulate, bracteole sparsely denticulate, perianth 5 mm. long. Stephani reduces *Lophocolea tasmanica* Mitten to a synonym of this species. Rodway describes it with underleaves rotund, 4–8 spines, perianth 5 mm. long ; he does not include *L. decurva* Mitt. in his List of Tasmanian Hepatics, but refers it to *Saccogyna australis* Mitt.

Plagiochila hartziana *Pearson* n. sp. Dioicous. Medium size, dark brown in colour, caespitose. Stems simple or slightly branched, firm. Leaves alternate, imbricate or approximate, horizontal (90°) to erecto-patent (30°), semi-broadly ovate or rotund, entire or with from 1 to 4 acute teeth, antical (lower) margin very decurrent, usually straight, postical (upper) rounded, ampliate, extending to the middle of the stem, only slightly decurrent, apex rotundate or acute (unidentate) or with several teeth extending to the upper margin ; cuticle smooth, polished ; cells medium size, 4-, 5- and 6-sided, walls firm, angles thickened, no trigones.

Dimensions. Stems 2·5 to 5 cm. long, ·2 mm. diam., with leaves 2 mm. wide ; leaves 2 mm. × 1·25 mm., 1·5 mm. × 1 mm., 1 mm. × ·7 mm. ; cells ·03 mm.

Although I have access to the fine collection of Australian *Plagiochilae* in the Manchester Museum, which I have examined carefully, there are no species to which I can refer this. I forwarded it to Mr. Rodway for his opinion, he thought it might be *P. Lyallii* Mitten and sent me specimens of the same, determined by Stephani, and of which I have other specimens. It is entirely different in shape of leaves, teeth and cell structure. The drawings are from stems, with rather more dentate leaves

than usual, the leaves are often entire or furnished with one acute tooth.

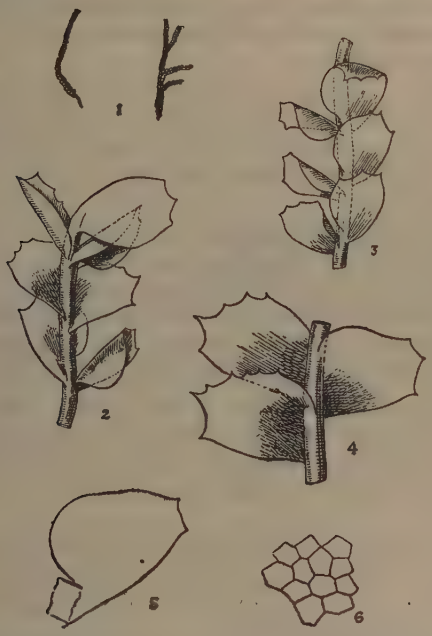


Fig. 1. Plants half nat. size. 2. Portion of stem, antical view (× 12). 3. Ditto, postical view (× 12). 4–5. Leaves (× 12). 6. Portion of leaf (× 145).

I have also been favoured with the loan of a number of Tasmanian Hepatics sent to Mr. W. E. Nicholson by Mr. Weymouth, which Mr. Nicholson and I have determined as follows :—

Aneura crassa (*Schwägr.*) *Nees*? Of which there is no satisfactory description. Nees (Syn. Hep. p. 500) places it with "Species dubiae" and Stephani (Sp. Hep. 274) with those unknown to him. A robust, coarse species, fronds about 2·5 cm. long, on cross-section slightly biconvex, 8 cells thick at the middle, cortical cells much smaller than inner, with dark walls, inner cells with hyaline walls, margin 2 cells thick.

Metzgeria concavula *Pearson* n. sp. Dioicous. Small, pale green in colour, densely stratose-caespitose, corticolous. Fronds repeatedly dichotomous, angle patent (50°) to erecto-patent (30°), margin much decurved, almost revolute, wings 12 cells wide, rarely 15 to 20, sparingly setose, margin setose, setae in pairs or more rarely single, straight or some slightly hamate, somewhat short and coarse, costa narrow, slender, 2 antical and 2 postical cortical cells, on cross-section rather broadly oval, 4 × 6 cells ; near the fork postical cortical cells 3, setose, densely so on some portions of the fronds ; cuticle slightly papillose ; cells 4-, 5- and 6-sided, moderate to rather large in size, walls thick, trigones minute. Calyptra long-clavate, pilose, hairs long, on upper portion more frequent. Capsule oval, valves pale reddish-brown ; spores golden-brown in colour, smooth,

elaters monospiral, reddish-brown in colour, long and very narrow. Androecia not seen. Gemmae abundant, marginal or rarely on the postical side of costa, usually oval-ligulate, but various in shape, disciform or stipitate, but all more or less remarkably concave.

Dimensions. Fronds 1·3 to 2·5 cm. long; 1·25 mm. wide, costa ·1 mm. wide; gemmae ·4 mm. × ·2 mm.; cells ·04 mm. × ·05 mm.; calyptra 1·25 mm. × ·4 mm. widest part; capsule ·5 mm. × ·35 mm.; spores ·03 mm.; elaters ·3 mm. long × ·01 mm.

Apart from the gemmiferous character of the plant, it differs from *M. nitida* Mitt., which has also a costa of 2 antical and 2 postical cortical cells, by its less transparent cells, thicker walls, smaller trigones, presence of setae on the wings, hardly papillose cuticle, shorter and stouter setae; in *M. nitida* they are very long and delicate; Stephani well names them cilia.

From *Metzgeria disciformis* Evans (Ann. of Bot. xxiv. 290) it differs in the more convex, narrower fronds with costa of 2 antical and 2 postical cortical cells, marginal setae in pairs, and in differently shaped gemmae, which are either marginal or postical.

Hab. Recherche—on Sassafrasin Forest, 200 ft: Tasmania, 19th January, 1911, *W. A. Weymouth* 1652. Recherche—on trees, Catamaran, near Ramsgate, Tasmania, 16th January, 1911, *W. A. Weymouth* 1654.

Metzgeria furcata (*L.*) *Lindb.* Monogr. Metzg. p. 35. Dioicous, non-gemmiparous, aeruginose, costa with 2 antical and 4 postical cortical cells, wings, costa and margin setose. Some of the fronds are remarkably broad and short. Stephani records the species from Tasmania (*Weymouth*).

Solenostoma rotata (*Tayl.*) *Mitt.* var. **exstipulata** *Pears.* I am somewhat uncertain about this determination; the plant is sterile and without underleaves. Bastow (Proc. Roy. Soc. Tasm. 1887, 234) in describing the species says underleaves "lanceolate or none".

Acrobolbus cinerascens (*L. et L.*) *Schiffn.*

Plagiochila radiculosa *Mitt.*

Lophocolea austroalpina *St.* Underleaves free.

L. heterophylloides *Nees.*

Chiloscyphus coalitus (*Hook.*) *Nees.* Stephani refers the specimens from Java distributed by Schiffner under this name to his *C. communis*. *C. coalitus* is a good type of the genus with the broad banded underleaves connate with the adjoining leaves; I have seen none such in the genus *Lophocolea*. The fig. 11, p. 592 in Goebel's "Organographie der Pflanzen" of *Lophocolea* from Malay is, in my opinion, a good figure of a *Chiloscyphus* and not a *Lophocolea*.

Lepidozia capilligera *Lindenb.* Syn. Hepat. 204. Dioicous. Medium size. Stems with 12 cortical cells, and opaque inner cells, graceful, delicate, bipinnate, pinna and pinnulae irregular in length, distant, alternate, slightly ascending, flagelliferous, some branches attenuate. Leaves distant, alternate, branch-leaves approximate, quadrifid, 8 cells wide at the base, 12 cells wide at the upper portion of disc, lobes 2 to 4 cells wide at the base ; cells rather large to large. Perianth sessile, narrowly oblong, 5-plicate at the upper portion, mouth minutely setulose, setae few. Bracts small, broadly ovate-quadrate, emarginate, margin with a few minute teeth ; bracteole broadly ovate, emarginate, margin entire. Androecia on chief stem or more often on attenuate branches, globose, with 2 pairs of bracts or catkin-like with 3 to 4 pairs of bracts, lobe ovate-acuminate, lobule similar but smaller.

Neither Lindenberg, Stephani nor any other authority seems to have seen either the male or fertile plant. Stephani describes the underleaves as being trifid ; they are quadrifid as Lindenberg figures them, on the branches they are trifid and bifid. Mr. Rodway says that *L. Oldfieldiana* St., specimens of which I have not seen, is a small form of *L. capilligera*.

Stephani describes this species as with small leaves regularly and remotely pinnate, disc 4 cells long and minute underleaves ; my specimens of *L. capilligera* have disc 6 to 8 cells long, with large underleaves.

Dimensions. Stems 2·5 to 3·7 cm. long, leaf-cells ·05 mm., basal ·08 mm. × ·04 mm. ; perianth 4mm. × ·75 mm. ; bracts ·9 mm. × ·65 mm. ; bracteole ·7 mm. × ·5 mm. ; perigonial bracts, lobe ·3 mm. × ·2 mm., lobule ·2 mm. × ·1 mm. ; bracteole ·15 mm. × ·1 mm. ; antheridia ·1 mm.

Radula aneurysmalis *Tayl.*

R. physoloba *Tayl.*

R. uvifera *Tayl.*

Drepanolejeunea latitans (*Tayl.*) *St.*

Mr. J. A. Wheldon has also sent me a few Tasmanian Hepatics collected at Russell's Falls, Russell's Falls River, Upper Derwent River, Macquarie Plains, in Aug.–Sept. 1909, but without the name of the collector.

Metzgeria nitida *Mitt.*

Hymenophytum phyllanthus (*Hook.*) *Dum.*

Tylimanthus saccatus (*Tayl.*) *Mitt.*

Chiloscyphus coalitus (*Hook.*) *Nees.*

Lepidozia asymmetrica *St.*

Isotachis subtrifida *Mitt.*

I. pusilla *St.*

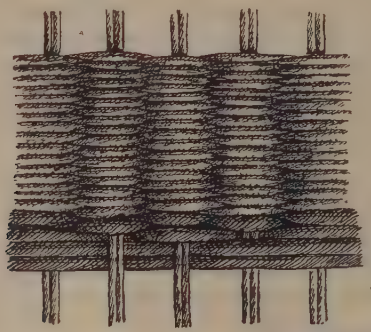
VI.—ANCIENT COTTON FABRICS IN THE SUDAN.

The accompanying sketch was made from a piece of fabric supplied by Mr. R. E. Massey, Government Botanist, Khartoum, who has also very kindly contributed the following article.

The discovery by Dr. Reisner during the last winter, in the tombs of the Greco-Roman period at Meroe, of textiles woven from cotton adds one more link to the chain of evidence that the cotton industry reached Egypt from the Sudan.

Meroe, the ruins of which are found some 60 miles south of the junction of the Atbara with the main Nile, was an important city and centre for trade with the Red Sea port of Ptolemais[1], Lower Egypt, and the lesser known regions of the South[2].

Pliny's statement[3] that " the Upper part of Egypt, towards Arabia, produces a shrub which some call Gossypion, and others Xylon " is well known, and the opinion expressed by Prosper Alpinus[4] that cotton was not grown in Egypt proper, but was imported from abroad, is generally believed to be correct.



Sketch of fabric, as it actually appears. (Straight weaving) x 10.

A lesser known inscription, which Dr. Reisner's discovery now confirms, is that found by Rüppell[5] in 1833 at Axum, in which an account of a raid on the Kasu or Meroitic Ethiopians by King Aeizanes is given. This king destroyed[6] " both towns of masonry and towns of grass huts, and sent expeditions up and down the Nile from the point of its junction with the Atbara. He seized their grain and their bronze, and their iron and their copper, and their implements for cultivating dura (?) and cotton " ! . . . . .

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[1] Probably modern Akik, see Crowfoot, J. W., "Some Red Sea Ports in the Anglo-Egyptian Sudan," Geographical Mag., May, 1911.

[2] An account of the trade with Ptolemais and the interior is given in " The Periplus of the Erythrean Sea " (c. A.D. 60), Schoff's translation, 1916.

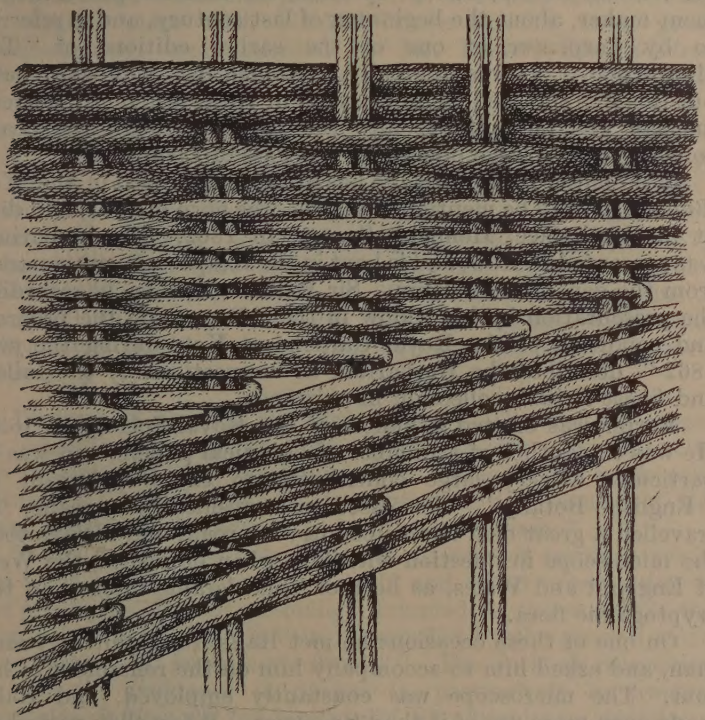
[3] " Historia Naturalis ", Gaius Plinius Secundus (c. A.D. 23–79).

[4] " De Plantis Aegypti ", Prosper Alpino, Venice, 1592.

[5] Littman, " Vorbericht der Deutschen Aksum—expedition ", Berlin, 1906.

[6] Crowfoot, J. W., " The Island of Meroé, ' 19th Memoir of the Archeological Survey of the Egypt Exploration Fund, 1911.

The suggestion was put forward in 1911 by Crowfoot[6] that the cotton trade of Meroe may have been one of its most valuable assets at this period (c. B.C. 200–A.D. 200).



Diagrammatic sketch to shew method of weaving and changing direction (strands loosened) x 14.

VII.—MISCELLANEOUS NOTES.

Mr. F. L. Squibbs, a member of the gardening staff of the Royal Botanic Gardens, has been appointed by the secretary of State for the Colonies, Assistant Superintendent, Botanical and Forestry Department, Hong Kong.

Mr. J. Pirie, a member of the gardening staff of the Royal Botanic Gardens, has been appointed by the Secretary of State for the Colonies, Agricultural Assistant, Gambia.

Borrer and Ralfs' Simple Triplet Microscope.—An interesting microscope which has been the property of three of the past generation of botanists has been presented to the Royal Botanic Gardens by Mr. C. V. B. Marquand. Its chief interest lies in the fact that it was the instrument with which John Ralfs, F.R.C.S., carried out the whole of his work for his well-known textbook, " British Desmidiaceae ", published in 1848.

The microscope, which consists of a simple stand and a large series of lenses used as " water immersions ", was specially made for William Borrer, F.R.S., by Ross, the famous optical instrument maker, about the beginning of last century, and is referred to by Carpenter in one of the earlier editions of " The Microscope". It was originally contained in a mahogany case, but this was smashed on an occasion in Wales when Mr. Borrer's luggage was precipitated into the ravine through the coach colliding with a large boulder in the Pass of Llanberis.

As no notice of Borrer's life has hitherto appeared in the *Kew Bulletin*, it may be mentioned that he was born in 1781, and died at his birthplace, Henfield, Sussex, in 1862. His herbarium was presented to Kew, and is kept in the Keeper's Room separate from the general herbarium. Sir William Hooker, in recording the presentation by his widow in the " Report on the progress and condition of the Royal Gardens at Kew during the year 1862 ", describes the Herbarium as unquestionably the fullest and finest British collection in existence.

Borrer was elected a Fellow of the Royal Society in 1835. He was the author of a number of botanical papers, and was in particular a very large contributor to the Supplement to " English Botany ". Possessed of considerable means, he travelled a great deal in this country by road, and always took the microscope in question with him when he visited the West of England and Wales, as he took considerable interest in the cryptogamic flora.

On one of these occasions he met Ralfs, then quite a young man, and asked him to accompany him on the remainder of his tour. The microscope was constantly employed, and Ralfs made even more use of it than its owner. When they parted at Bangor Borrer pressed Ralfs to accept it.

The present donor inherited it from his father, Mr. E. D. Marquand, who had long been associated with Ralfs, and to whom the latter presented it on December 5th, 1883, not long before his own death at the age of 83. Mr. Marquand made a note of the exact words, which were as follows :—" I want you to accept this little microscope of mine as a memorial of me when I am gone. I had intended to leave it to you at my death, but I may just as well have the pleasure of giving it to you now. You must remember that it was with it that I did the whole of my work, all my papers and my Desmids, so you see it has a history ".

The Botanical Magazine.—The following plants are figured in Part I. of Volume CXLIX :—*Phytolacca clavigera* W. W. Smith (t. 8978), from a specimen raised at Edinburgh from an odd lot of seed amongst the collections of G. Forrest, from Yunnan ; *Maxillaria chrysantha* Barb. Rodriguez (t. 8979), which has been in cultivation at Glasnevin for some years as *M. Galeottiana*, and has only recently been determined ; *Viburnum Davidii* Franch. (t. 8980), from China, with dark green foliage forming a striking contrast to the white flowers and

bluish fruits ; *Candidea stenostegia* Stapf (t. 8981), a new species described from specimens raised at Edinburgh from Northern Nigerian seed ; *Caralluma pseudo-N. E. Brownii* Dinter (t. 8982), an elegant plant with blackish-brown flowers, from great Namaqualand, communicated by Mr. Elwes ; *Rhododendron Thayerianum* Rehder and Wilson (t. 8983), a charming plant from Western Szechuan, contributed by Mr. J. C. Williams ; *Turraea floribunda* Hochst. (t. 8984), a deliciously scented shrub from Natal, flowered at Kew ; *Sempervivella alba* Stapf (t. 8985), a pretty little plant from India, grown by Mr. Elwes ; *Primula calciphila* Hutchinson (t. 8986), an interesting Chinese plant, from Ichang ; *Tecophilaea cyanocrocus* Leyb. (t. 8987), a beautiful dark blue and white flowered bulb from Chile ; *Rhododendron lacteum* Franch. (t. 8988), from the mountains of Yunnan ; *Cyclamen balearicum* Willk. (t. 8989), with small delicately-coloured flowers, only known from the Balearic Islands.

Diseases of Crops in the West Indies.*—This volume covers far more than is suggested by its modest title. As stated in the " Foreword " by Professor J. B. Farmer, the work constitutes " a real landmark of progress in the science of the plant considered in relation to health and disease."

While dealing specially with the diseases of crops grown in the West Indies, the work is a lucid and broad presentation of the principles of plant pathology, founded on the text that the economic mycologist " is being compelled by the general trend of experience to be an agriculturist." The author's conviction is that the incidence of disease is, particularly in tropical countries, influenced fundamentally by agricultural practice—a view which was shared by the late C. O. Farquharson for conditions in Nigeria. (See *Kew Bull.*, 1918, p. 354.)

This broad connected outlook binds together a mass of information as to the various problems dealt with, derived both from personal experience and from the thorough consideration of recent literature.

The book is divided into two parts. The first part (114 pages) deals with the nature and classification of plant diseases and the principles of control. Chapters are given on diseases due to fungi, those caused by bacteria, infective viruses, nematodes, phanerogamic parasites, and non-parasitic diseases. There is also included a useful summary of our knowledge as to relations between insects and disease, and some account of entomogenous fungi. Under the heading of " Control " the properties and uses of various fungicides are explained, and the general method given of treating certain classes of disease, such as wood-rots, damping-off, etc.

The second part of the book (248 pages) is prefaced by an account of agricultural conditions in the Lesser Antilles.

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* Diseases of Crop Plants in the Lesser Antilles, by W. Nowell. Published on behalf of the Imperial Department of Agriculture by the West India Company, London. 1923. pp. 383 ; figs. 150. Price 12s. 6d.

Following this are three sections, the first dealing with some general diseases which are common to various crops, the second with diseases of permanent crops such as Cacao, Coconut, Hevea, etc., and the third with diseases of arable crops.

Copious illustrations from photographs and line drawings are supplied, and the book is clearly printed and light to handle.

A. D. C.

Diseases of Glasshouse Plants.*—As Director of the Cheshunt Experimental and Research Station, Dr. Bewley has had unrivalled opportunities for studying the diseases of such crops as tomatoes and cucumbers grown intensively and on a large scale, and of utilising the specialised practical knowledge of a body of keen and up-to-date growers. Of these opportunities Dr. Bewley has taken full advantage, and the present book is the outcome.

As stated in the preface the object of the book is "to bring before growers of glasshouse plants the fundamental principles of disease control." In pursuance of this aim, Dr. Bewley starts with a chapter on the general construction and sanitation of glasshouses, followed by a second on the various environmental conditions which may predispose plants to disease. Chapters 3—7 deal in detail with special diseases of various plants, classified as Root diseases, Wilt diseases, Stem, Leaf and Fruit diseases, Bacterial diseases, and Mosaic diseases. Naturally the greater part of this section refers to diseases of Tomatoes and Cucumbers, but mention is made also of some of those other plants, such as Rose, Carnation, Chrysanthemum, bulbous plants, etc. The concluding chapters are occupied with a general consideration of the treatment of plant diseases, including such questions as soil sterilisation, spraying and dusting, and plant hygiene.

In any future edition the utility of the book could be improved by careful scrutiny of the citations, both of references and of names. Reference to a systematic mycologist would obviate such confused citations as "Diplodina lycopersici Cooke, Holtos emend., Brooks & Searle" (p. 89).

E. M. W.

University Botanic Garden, Tokyo.—We have received an interesting little Guide to the Botanic Garden of the Imperial University of Tokyo, Japan, printed in English. From it we gather that the garden covers an area of about 45 acres, and has developed from a medicinal garden established nearly two hundred years ago. This Guide furnishes a plan of the garden, and gives an account of its main features as well as of the most interesting trees and plants to be seen. It is illustrated by fourteen reproductions of photographs. No price is stated.

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* "Diseases of Glasshouse Plants," by W. F. Bewley, D.Sc. Published by Ernest Benn, Ltd., 8, Bouverie Street, E.C. 4. 1923. Price 12s. 6d. net.

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